Ministry of Education and Science of Ukraine
Ternopil Ivan Pul'uj National Technical University
Faculty of Engineering of Machines, Structures and Technologies
Manufacturing Engineering Department

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UDC 621.9

DESIGN DEVELOPMENT OF MACHINE SHOP AREA FOR THE COVER KS6-57.017 MANUFACTURE INCLUDING THE STUDY OF THE CUTTER MICRO GEOMETRICAL DEVIATIONS IN CUTTING PROCESS BY FINITE ELEMENTS METHOD

specialty 131 «Applied mechanics»
field of knowledge 13 "Mechanical engineering"

Synopsis
of master's degree diploma

Ternopil - 2019

Diploma was done on Manufacturing Engineering Department of Ternopil Ivan Pul'uj National Technical University of Ministry of Education and Science of Ukraine

Supervisor: Ph.D., Assoc. Prof., Manufacturing Engineering Department
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Diploma defence will be held on 26 of December 2019 at 10.00 am at the meeting of the examination commission №3 at the Ternopil Ivan Puliuy National Technical University at: 46001, Ternopil, 4 Lukianovych street, education building №11, classroom 11.

GENERAL CHARACTERISTICS OF THE WORK

Relevance of the topic of work. Details of the type "cover" refers to the bodies of rotation (type hollow cylinder), included in the assembly of the running gear of the beet harvester. Its functional purpose is that it serves as a body part for installing the shaft of the wheel and tapered bearings, as well as for facilitating the assembly of components. The most widespread technological operations in the manufacture of a cover are a fine and rough turning, diamond boring.

Therefore, the development of technological processes of processing such details and designing on their basis production sites is an urgent scientific and practical task that has determined the direction of research of the thesis.

The purpose of the work: development of a project of a section of a machine shop for the manufacture of the cover KS6-57.017 with the study of microgeometry of the cutter in the process of cutting by the finite elements method.

Object, methods and sources of research. The main object of the research is the technological process of manufacturing a given part and the manufacturing process of a machine shop. Methods of work: economic-statistical, graphic, comparative, mathematical modeling; theoretical and empirical.

The results were obtained:

- the deviation of the microgeometry of the cutter in the process of cutting by the finite element method is investigated;
- the design and the service purpose of the production object were analyzed, the manufacturability analysis was carried out;
- methods of manufacturing similar parts are investigated;
- the technological process of manufacturing a given part for which the equipment, equipment cutting and measuring tools was selected, design, cutting modes and time norms were performed;
- the necessary technological equipment is selected and designed;
- feasibility study of the decisions made;
- issues of information technology, occupational safety, emergency safety and ecology are considered;
- a section of the machine shop was designed for the manufacture of the cover.

The practical significance of the results obtained.

A real technological process has been developed that can be implemented under conditions of real production. The technique of optimizing the layout of production equipment that can be used in practical activity is considered.

Approbation. Some results were reported on the International scientific and technical student's conference of TNTU "Fundamental and applied sciences. Actual questions" 26th-27th of April 2018.

Structure of work. The work consists of an explanatory note and a graphical part. The explanatory note consists of an introduction, 9 parts, conclusions, a list of references and appendices. Volume of work: calculation and explanatory note - 144 sheets A4 size, graphic part - 10 drawings A1 size.

MAIN CONTENT OF THE WORK

In the introduction is an overview of the current state of the machine-building industry and the main tasks that need to be solved in the master's work are described.

In the analytical part, the analysis of the status of the issue by literary and other sources is conducted, the relevance of the work is substantiated, the problem statement for the thesis is fulfilled.

The research part presents the results of studies of factors that influence the change of the geometrical parameters of the cutting tool in the process of machining, theoretically and experimentally determined the deviation of the micro geometric parameters of the cutter, the modeling of the microgeometry of the cutting tool by the finite element method**.**

In the technological part, the characteristics of the type and organizational form of production are presented, the choice of the method of obtaining the workpiece and the requirements that are put to it are substantiated. The allowances for surface treatment of the workpiece are calculated in an analytical manner. A dimensional analysis of the technological process is carried out. The technological process route for the machining operations of the cover has been developed. Cutting modes are calculated and operations are normalized.

In the design part, the selection and design of technological equipment for the manufacture of parts is made. The calculations and the principle of the action of devices for drilling holes and control of radial beating, conductor for drilling holes are given.

The special part presents the structure and composition of CAD. The components and types of information support of CAD are analyzed, the questions of designing of technological processes of manufacturing of parts with the help of a package of application programs "TPP CAD" are considered, the algorithm and the block diagram of the automated design of technological process of manufacturing of a cover are developed.

In the design part, the design of the production site for the implementation of the developed technological process was carried out: the program of production at the site was clarified, the complexity and machine-tool production of products were calculated on the basis of the developed technological processes, determination of the annual need for technological equipment, compilation of consolidated information of equipment, determination of quantitative composition of the equipment department, determining the size of the main and auxiliary areas of the workshop and the site, determining the main dimensions and the choice of type and construction of the building, the layout of the shop layout plan for the placement of equipment, the selection of load and transport vehicles.

In the part "Justification of economic efficiency" the issues of production organization are considered and calculations of technical and economic efficiency of design decisions are made.

In the part "Occupational Safety and Security in Emergency Situations" the issues of organization of occupational safety at the production and on the designed site are considered, the dangerous production factors in the shop are analyzed and measures are taken to reduce them. Systems of means and measures for safe operation of electrical installations are considered.

In the part "Ecology", the influence of components of machine-building complex on the environment, the causes of pollution of the hydrosphere are considered, the measures on environmental protection and the choice of equipment for catching dust, fog, sewage treatment, etc. are substantiated.

The general conclusions on the thesis describe the technical solutions adopted in the project and organizational and technical measures that ensure the completion of the design task; original technical decisions made by the author in the process of master's work that can be implemented in production; the choice of the project variant of technology according to certain technical and economic indicators.

The annexes to the explanatory note contain the specifications, a set of technological documentation.

In the graphic part shows the details of the designation with the coordinate axes and surfaces, the drawing of the workpiece, diagrams of technological adjustments, assembly drawings of technological equipment, plan of placement of equipment at the machining section, the results of comparative analysis of technology options and the results of scientific research.

CONCLUSIONS

The scientific and engineering decisions made in the master's work allowed to design the machining section for the manufacture of "cover" type details and to achieve a significant improvement of certain technological process indices. The workpiece manufacturing process developed is more sophisticated and has significant advantages over the underlying process.

The analysis of the technological process obtained with the help of CAD was carried out, as well as the technical and economic calculations of the two technological processes were performed and the most economically advantageous one was selected.

The proposed changes make it possible to reduce the amount of equipment used, and therefore reduce the production space and the number of basic workers employed. The introduction of a new machine allows you to process a part in one operation for three institutions, which improves the quality of production, reduces processing time, increases the complexity of operations, reduces the cost of manufacturing parts. m

Thanks to the application of CAD TP, another variant of the machining route was synthesized, which combined with the existing ones allowed to design the optimal technological route of machining.

The cost-effectiveness calculations confirmed the correctness of the design decisions made and showed that the implementation of the new technological process reduced the total cost of production, the volume of capital investments, improved the technical and economic indicators of the site.

REFERENCES

1. A handbook of a technologist-machine builder in 2 volumes of T1. Ed. A.G. Kosilova and R.K. Meshcheryakova - 4th ed. Recycled and supplemented - M .: Mashinostroenie, 1986. - 656 p.

2. A handbook of the technologist-machine builder In 2 volumes of T2. Ed. A.G. Kosilova, R.K. Meshcheryakova - 4th ed. Recycled and supplemented - M .: Mashinostroenie, 1986. - 496 p.

3. Adusei Ebenezer. Features of the high-speed machining of the hard materials / Danylchenko L., Adusei Ebenezer. Book of abstract of the International scientific and technical student's conference "Fundamental and applied sciences. Actual guestions" 26th-27th of April 2018. – Ternopil: TNTU, 2018. – P. 173-174

4. F. M. Aherio et al. Turning hardened steel using coated carbide at high cutting speed. Journal of the Brazilian society of Mechanical Science and Engineering vol, 2, 2009. – P. 11 - 29.

5. Anuriev, V.I. Handbook of the designer-machine builder. [Text] / V.I. Anuriev. In 3 volumes vol. T.1. Ed. 6 th revision. and additional. - M .: Mechanical Engineering, 1982. - 736 p.

6. Automated design of technological processes: A manual. [Text] / SM Solovyov, O.L. Nikol'ev, MM Ivakhnenko, O.P. Gorzy - Nikolaev: View of UDMTU, 2001. - 63 p.

7. C.S. Chang and K.H. Fuh. A force model of single point cutting tool with a chamfered main cutting edge when wearing has occurred. Journal of Materials Processing Technology 66(1997), 1995. – P. 49-62.

8. Diploma design on technology of machine building [Text] / Ed. VV Grandma - Minsk: Higher school, 1979. - 464.

9. Dobryansky, S.S. Technology of mechanical engineering and technological bases of mechanical engineering. [Text] / S.S. Dobryansky, V.K. Frolov, Yu.M. Malafeev, V.M. Gritsenko - K .: NTUU "KPI", 2007. - 72 p.

10. General machine-building standards of time and cutting modes for standardization of work performed on universal and multi-purpose machine tools with CNC. [Text] / Part 2. Rules of cutting modes. - Moscow: Economics, 1990. - 474 p.

11. Gevko, B.M. Methodical instructions for the qualification work of the master's degree specialty 8.090202. [Text] / B.M. Hevko, Yu.B. Kapatsila, IG Tkachenko - Ternopil: View of the TSTU, 2002. - 35 p.

12. Gevko, Iv.B, Oxentyuk, AO, Galushchak, MP Organization of production: Theory and practice: Textbook. [Text] / Iv.B. Gevko, A.O. Oxentyuk, MP Galuchak - K.: Condor, 2008. - 178 p.

13. Gorbatsevich, A.F. Course designing in engineering technology: Textbook for high schools. [Text]/A.F. Gorbatsevich, V.A.Shkred Izd. 5th - M.: Alliance, 2007. – 256 p.

14. Gorbatyuk, E.O. Technology of mechanical engineering. [Text] / E.O. Gorbatyuk, M.P. Mazur, A.S. Zenkin, V.D. Karazey - K.: "New World", 2009. - 360 p.

15. Ilyankov, A.I. Engineering Technology: Practicum and course design. [Text] / A.I. Ilyankov, V.Yu. Novikov - Moscow: Academy, 2012. - 432 pp.

16. Kohut, M.S. Mechano-assembly workshops and sections in machine-building: Textbook. [Text] / MS Cock. - Lviv: View of the National University "Lviv Polytechnic", 2000 - 352 p.

17. Kondakov, A.I. CAD process technology. [Text] / AI Kondakov - Moscow: Academy, 2007. - 272 p.

18. Korsakov, V.S. Fundamentals of device design: A textbook for high schools. [Text] / VS Korsakov. - 2nd ed. redone and add - Moscow: Mechanical Engineering, 1983. - 277 p.

19. Kuznetsov, Yu.I., Maslov, A.R., Baikov, A.N. Accessories for CNC machines: Directory. [Text] / Yu.I. Kuznetsov, AR Maslov AN Baikov. - 2nd ed. redone and add - M .: Mashinostroenie, 1990. - 512 p.

20. D. Lathwal and D. Bhardwaj. Study and analysis of single point cutting tool under variable rake angle. IJRASET vol. 1, issue 1, 2013. – P. 54 – 83.

21. Matalin, L.A. Technology of Mechanical Engineering: Textbook for Mechanical Engineering Universities specializing in "Technology of Machine-Building, Metal Cutting Machines and Tools". [Text] / L.A. Matalin - L .: Mechanical engineering, Leningrad. Отд-ние, 1985. - 496 p.

22. R. Miroslav. Experimental determination of cutting forces by longitudinal turning of C60E steel. Romanian Technical Science Academy. Vol. 2., 2006. – P. 203-229.

23. Processing of materials by cutting: Handbook of technologist. [Text] / A.A. Panov, V.V. Anikin, N.G. Boim and others. - By common. Ed. A.A. Panova - M .: Mashinostroenie, 1988 - 736 p.

24. V.B. Renjith. Influence of process parameters on cutting forces and Taguchi based prediction of T42-CT H.S.S single point cutting tool deflection. International Journal of Science and Research Publication vol. 3, issue 7, 2013. – P. 118-127.

25. Rudenko, P.O. Design of technological processes in mechanical engineering: A manual. [Text] / P.O. Rudenko - K.: Higher school, 1993. - 414 p.

26. L. S. Srinath Advance mechanics of solids. Tata McGraw hill education private limited, New Delhi, 2009. – 283 p.

27. Solovjov, SM Automated design of technological processes: Tutorial. [Text] / S.M. Solovyov, O.L. Nikolayev, MM Ivakhnenko, O.P. Gorzy - Nikolaev: UDMTU, 2001. - 63 p.

ANNOTATION

Adusei Ebenezer. Design development of machine shop area for the cover KS6-57.017 manufacture including the study of the cutter micro geometrical deviations in cutting process by finite elements method. Abstract of the thesis for master's degree: speciality 131 "Applied mechanics". - Ternopil Ivan Puluj National Technical University. - Ternopil, 2019.

The thesis develops the design of machine shop area for manufacturing the cover and researching the deviations of micro geometrical parameters during the cutting process by finite elements method.

Key words: technology, process, shop area, machine tool, machining